

## **AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application:

### **Listing of Claims:**

- 1           1.       (Original) A method for discovering remote nodes in an Ethernet  
2       passive optical network which includes a central node and at least one remote  
3       node, wherein downstream data from the central node is broadcast to the remote  
4       nodes, and wherein upstream data from each remote node is transmitted to the  
5       central node in a unicast manner, the method comprising:  
6                receiving a solicitation message from the central node, wherein the  
7       solicitation message includes a time stamp indicating the solicitation message's  
8       transmission time and assigns a starting time and size for a discovery slot in which  
9       the remote node is allowed to transmit a response message to the central node for  
10      registration;  
11               setting a local time at the remote node according to the received time  
12      stamp; and  
13               after a random delay from the beginning of the discovery slot,  
14      transmitting the response message to the central node during the discovery slot  
15      with a response transmission probability that is less than or equal to one.
  
- 1           2.       (Original) The method of claim 1, further comprising setting the  
2       value of the response transmission probability according to how many times the  
3       remote node has failed in registering with the central node.

1           3.       (Original) The method of claim 2, wherein the value of the  
2       response transmission probability is  $C_f^{-(j-1)}$ , where  
3            $j$  is the number of previously failed registration attempts by the remote  
4       node; and  
5            $C_f$  is a positive number greater than 1.

1           4.       (Original) The method of claim 1, wherein the central node sets  
2       the value of the response transmission probability and specifies the response  
3       transmission probability within the solicitation message.

1           5.       (Original) The method of claim 4, further comprising  
2       setting the value of the response transmission probability according to the  
3       maximum number of undiscovered remote nodes that may transmit response  
4       messages for registration with the central node;  
5           wherein the maximum number of undiscovered remote nodes that may  
6       transmit response messages decreases as the number of discovered remote nodes  
7       increases in an EPON with fixed maximum number of allowable remote nodes.

1           6.       (Original) The method of claim 1, further comprising  
2       setting the size of the discovery slot according to the maximum number of  
3       undiscovered remote nodes that may transmit response messages for registration  
4       with the central node;  
5           wherein the maximum number of undiscovered remote nodes that may  
6       transmit response messages decreases as the number of discovered remote nodes  
7       increases in an EPON with fixed maximum number of allowable remote nodes.



7             $E$  is the maximum round-trip propagation delay between the central node  
8            and any remote node.

1            11.     (Original) The method of claim 10, further comprising  
2            storing values of the size of the discovery slot in a table based on different  
3            maximum numbers of undiscovered remote nodes that may transmit response  
4            messages; and  
5            before sending out the solicitation message, retrieving value of the size of  
6            the discovery slot based on the current maximum number of undiscovered remote  
7            nodes that may transmit response messages.

1            12.     (Original) The method of claim 6, wherein size of the discovery  
2            slot is approximately:  
3             $n \cdot T + \sqrt{n^2 \cdot T^2 + 2 \cdot T \cdot E \cdot (n - 1)}$ ; where  
4             $T$  is the transmission busy time of the response message;  
5             $n$  is the maximum number of undiscovered remote nodes that may transmit  
6            response messages; and  
7             $E$  is the maximum round-trip propagation delay between the central node  
8            and any remote node.

1            13.     (Original) The method of claim 12, further comprising  
2            storing values of the size of the discovery slot in a table based on different  
3            maximum numbers of undiscovered remote nodes that may transmit response  
4            messages; and  
5            before sending out the solicitation message, retrieving value of the size of  
6            the response transmission period based on the current maximum number of  
7            undiscovered remote nodes that may transmit response messages.

1           14.     (Original) An apparatus for discovering remote nodes in an  
2     Ethernet passive optical network, comprising:  
3           a central node;  
4           at least one remote node that is configured to,  
5                 receive a solicitation message from the central node, wherein the  
6           solicitation message includes a time stamp indicating the solicitation  
7           message's transmission time and assigns a starting time and size for a  
8           discovery slot in which the remote node is allowed to transmit a response  
9           message to the central node for registration;  
10          set a local time at the remote node according to the received time  
11          stamp; and  
12          after a random delay from the beginning of the discovery slot,  
13          transmit the response message to the central node during the discovery slot  
14          with a response transmission probability that is less than or equal to one;  
15          wherein downstream data from the central node is broadcast to the remote  
16   nodes, and wherein upstream data from each remote node is transmitted to the  
17   central node in a unicast manner.

1           15.     (Original) The apparatus of claim 14, wherein the remote node is  
2     further configured to set the value of the response transmission probability  
3     according to how many times the remote node has failed in registering with the  
4     central node.

1           16.     (Original) The apparatus of claim 15, wherein the value of the  
2     response transmission probability is  $C_j^{-(j-1)}$ , where  
3           j is the number of previously failed registration attempts by the remote  
4     node; and

5             $C_j$  is a positive number greater than 1.

1            17.    (Original) The apparatus of claim 14, wherein the central node is  
2    configured to set the value of the response transmission probability and specifies  
3    the response transmission probability within the solicitation message.

1            18.    (Original) The apparatus of claim 17, wherein the central node is  
2    further configured to,  
3            set the value of the response transmission probability according to the  
4    maximum number of undiscovered remote nodes that may transmit response  
5    messages for registration with the central node;  
6            wherein the maximum number of undiscovered remote nodes that may  
7    transmit response messages decreases as the number of discovered remote nodes  
8    increases in an EPON with fixed maximum number of allowable remote nodes.

1            19.    (Original) The apparatus of claim 14, wherein the central node is  
2    configured to,  
3            set the size of the discovery slot according to the maximum number of  
4    undiscovered remote nodes that may transmit response messages for registration  
5    with the central node;  
6            wherein the maximum number of undiscovered remote nodes that may  
7    transmit response messages decreases as the number of discovered remote nodes  
8    increases in an EPON with fixed maximum number of allowable remote nodes.

1            20.    (Original) The apparatus of claim 19, wherein the size of the  
2    discovery slot is proportional to the maximum number of undiscovered remote  
3    nodes that may transmit response messages, and is also proportional to  
4    transmission busy time of the response message.

1           21.     (Original) The apparatus of claim 20, wherein the size of the  
2     discovery slot is precisely or approximately equal to  $C_s \times n \times T$ , where  
3            $C_s$  is a positive number;  
4            $n$  is the maximum number of undiscovered remote nodes that may transmit  
5     response messages; and  
6            $T$  is the transmission busy time of the response message.

1           22.     (Original) The apparatus of claim 21, wherein the central node is  
2     further configured to,  
3           store values of the size of the discovery slot in a table based on different  
4     maximum numbers of undiscovered remote nodes that may transmit response  
5     messages; and  
6           before sending out the solicitation message, retrieve a value of the size of  
7     the discovery slot based on the current maximum number of undiscovered remote  
8     nodes that may transmit response messages.

1           23.     (Original) The apparatus of claim 19, wherein size of the  
2     discovery slot is approximately:  
3           
$$\frac{T \cdot (2n-1) + \sqrt{T^2 \cdot (2n-1)^2 + 8 \cdot T \cdot E \cdot (n-1)}}{2};$$
 where  
4            $T$  is the transmission busy time of the response message;  
5            $n$  is the maximum number of undiscovered remote nodes that may transmit  
6     response messages; and  
7            $E$  is the maximum round-trip propagation delay between the central node  
8     and any remote node.

1           24.     (Original) The apparatus of claim 23, wherein the central node is  
2     further configured to,

3 store values of the size of the discovery slot in a table with regard to  
4 different maximum numbers of undiscovered remote nodes that may transmit  
5 response messages; and  
6 before sending out the solicitation message, retrieve value of the size of  
7 the discovery slot based on the current maximum number of undiscovered remote  
8 nodes that may transmit response messages.

1 25. (Original) The apparatus of claim 19, wherein size of the  
2 discovery slot is approximately:  
3 
$$n \cdot T + \sqrt{n^2 \cdot T^2 + 2 \cdot T \cdot E \cdot (n - 1)}; \text{ where}$$
  
4  $T$  is the transmission busy time of the response message;  
5  $n$  is the maximum number of undiscovered remote nodes that may transmit  
6 response messages; and  
7  $E$  is the maximum round-trip propagation delay between the central node  
8 and any remote node.

1 26. (Original) The apparatus of claim 25, wherein the central node is  
2 further configured to  
3 store values of the size of the discovery slot in a table based on different  
4 maximum numbers of undiscovered remote nodes that may transmit response  
5 messages; and  
6 before sending out the solicitation message, retrieve value of the size of  
7 the response transmission period based on the current maximum number of  
8 undiscovered remote nodes that may transmit response messages.

1 27. (Original) A computer-readable storage medium storing  
2 instructions that when executed by a computer cause the computer to perform a



3 method for discovering remote nodes in an Ethernet passive optical network  
4 which includes a central node and at least one remote node, wherein downstream  
5 data from the central node is broadcast to the remote nodes, and wherein  
6 upstream data from each remote node is transmitted to the central node in a  
7 unicast manner, the method comprising:  
8 receiving a solicitation message from the central node, wherein the  
9 solicitation message includes a time stamp indicating the solicitation message's  
10 transmission time and assigns a starting time and size for a discovery slot in which  
11 the remote node is allowed to transmit a response message to the central node for  
12 registration;  
13 setting a local time at the remote node according to the received time  
14 stamp; and  
15 after a random delay from the beginning of the discovery slot, transmitting  
16 the response message to the central node during the discovery slot with a response  
17 transmission probability that is less than or equal to one.

1 28. (Original) The computer-readable storage medium of claim 27,  
2 wherein the method further comprises setting the value of the response  
3 transmission probability according to how many times the remote node has failed  
4 in registering with the central node.

1 29. (Original) The computer-readable storage medium of claim 28,  
2 wherein the value of the response transmission probability is  $C_f^{-(j-1)}$ , where  
3  $j$  is the number previously failed registration attempts by the remote node;  
4 and  
5  $C_f$  is a positive number greater than 1.

1           30.     (Original) The computer-readable storage medium of claim 27,  
2     wherein the central node sets the value of the response transmission probability  
3     and specifies the response transmission probability within the solicitation  
4     message.

1           31.     (Original) The computer-readable storage medium of claim 30,  
2     wherein the method further comprises  
3             setting the value of the response transmission probability according to the  
4     maximum number of undiscovered remote nodes that may transmit response  
5     messages for registration with the central node;  
6             wherein the maximum number of undiscovered remote nodes that may  
7     transmit response messages decreases as the number of discovered remote nodes  
8     increases in an EPON with fixed maximum number of allowable remote nodes.

1           32.     (Original) The computer-readable storage medium of claim 27,  
2     wherein the method further comprises  
3             setting the size of the discovery slot according to the maximum number of  
4     undiscovered remote nodes that may transmit response messages for registration  
5     with the central node;  
6             wherein the maximum number of undiscovered remote nodes that may  
7     transmit response messages decreases as the number of discovered remote nodes  
8     increases in an EPON with fixed maximum number of allowable remote nodes.

1           33.     (Original) The computer-readable storage medium of claim 32,  
2     wherein the size of the discovery slot is proportional to the maximum number of  
3     undiscovered remote nodes that may transmit response messages, and is also  
4     proportional to transmission busy time of the response message.

1           34.     (Original) The computer-readable storage medium of claim 33,  
2     wherein the size of the discovery slot is precisely or approximately equal to  $C_s \times n$   
3      $\times T$ , where  
4            $C_s$  is a positive number;  
5            $n$  is the maximum number of undiscovered remote nodes that may transmit  
6     response messages; and  
7            $T$  is the transmission busy time of the response message.

1           35.     (Original) The computer-readable storage medium of claim 34,  
2     wherein the method further comprises  
3           storing values of the size of the discovery slot in a table based on different  
4     maximum numbers of undiscovered remote nodes that may transmit response  
5     messages; and  
6           before sending out the solicitation message, retrieving a value of the size  
7     of the discovery slot based on the current maximum number of undiscovered  
8     remote nodes that may transmit response messages.

1           36.     (Original) The computer-readable storage medium of claim 32,  
2     wherein size of the discovery slot is approximately:  
3           
$$\frac{T \cdot (2n-1) + \sqrt{T^2 \cdot (2n-1)^2 + 8 \cdot T \cdot E \cdot (n-1)}}{2}$$
; where  
4            $T$  is the transmission busy time of the response message;  
5            $n$  is the maximum number of undiscovered remote nodes that may transmit  
6     response messages; and  
7            $E$  is the maximum round-trip propagation delay between the central node  
8     and any remote node.

1           37. (Original) The computer-readable storage medium of claim 36,  
2       wherein the method further comprises  
3           storing values of the size of the discovery slot in a table based on different  
4       maximum numbers of undiscovered remote nodes that may transmit response  
5       messages; and  
6           before sending out the solicitation message, retrieving value of the size of  
7       the discovery slot based on the current maximum number of undiscovered remote  
8       nodes that may transmit response messages.

1           38. (Original) The computer-readable storage medium of claim 32,  
2       wherein size of the discovery slot is approximately:  
3           
$$n \cdot T + \sqrt{n^2 \cdot T^2 + 2 \cdot T \cdot E \cdot (n - 1)}$$
; where  
4            $T$  is the transmission busy time of the response message;  
5            $n$  is the maximum number of undiscovered remote nodes that may transmit  
6       response messages; and  
7            $E$  is the maximum round-trip propagation delay between the central node  
8       and any remote node.

1           39. (Original) The computer-readable storage medium of claim 38,  
2       wherein the method further comprises  
3           storing values of the size of the discovery slot in a table based on different  
4       maximum numbers of undiscovered remote nodes that may transmit response  
5       messages; and  
6           before sending out the solicitation message, retrieving value of the  
7       size of the response transmission period based on the current maximum number of  
8       undiscovered remote nodes that may transmit response messages.